

REMARKS

Re-examination and favorable reconsideration in light of the above amendments and the following comments are respectfully requested.

Claims 1 - 26 are pending in the application. Of these claims, claims 1 - 11 and 24 - 26 stand rejected; claims 4 and 10 stand objected to, and claims 12 - 23 are withdrawn from consideration as being directed to a non-elected invention.

By the present amendment, claims 4 and 10 have been placed into independent form and claims 3 and 11 have been amended to correct inadvertent, typographical errors.

In the office action mailed September 30, 2002, claims 4 and 11 were rejected under 35 U.S.C. 112, second paragraph; claims 1 - 3, 5, 6, 24, and 26 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,366,695 to Erickson; and claims 4, 7 - 11, and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over said Erickson patent.

The foregoing rejections are traversed by the present response.

The present invention relates to a nickel base superalloy having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free. The nickel base superalloy, in a preferred embodiment, has a composition comprising 3.0 to 12 wt% chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, up to 5.0 wt% rhenium,

6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt% carbon, up to 0.02 wt% boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting of ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel. The microstructure of the nickel base superalloy preferably has a gamma prime morphology which includes a bimodal γ' distribution.

The nickel based superalloys of the present invention have particular utility in the manufacture of components to be used in a hydrogen environment such as turbine blades and vanes in liquid hydrogen fueled rocket propulsion systems.

The office action records a telephone restriction requirement made by the Examiner and a telephone election made by the undersigned attorney. Restriction was required between the following groups of invention: (I) claims 1 - 11 and 24 - 26, drawn to a nickel-based alloy, classified in class 148, subclass 426; and (II) claims 12 - 23, drawn to a method of producing a nickel-based alloy, classified in class 148, subclass 555.

Applicants hereby confirm the telephone election of the invention of Group I, claims 1 - 11 and 24 - 26 for the purposes of prosecution. While the telephone election was made with

traverse, Applicants hereby withdraw the traverse upon further consideration.

The objection to claims 4 and 10 contained in the office action are duly noted; however, this objection is not well taken. Applicants have reviewed page 7, lines 2 - 3 of the specification and do not find any definition of "fine γ ' particles". Applicants do however find a size range for such fine particles. There is nothing improper about claims 4 and 10 because they merely further define the fine particles by setting a size range. The Examiner is hereby requested to withdraw the objection.

The rejection under 35 U.S.C. 112, second paragraph is duly noted. By the present amendment, a minor typographical error in claim 3 has been corrected. As a result of this correction, there is antecedent basis in claim 4 for the phrase "said large γ ' particles". With regard to claim 11, this claim has been amended to add the word "particles" after the phrase "said large γ '". In view of these amendments, the rejection under 35 U.S.C. 112, second paragraph have been obviated.

In said office action, claims 1 - 3, 5 - 6, 24 and 26 were rejected as being anticipated by Erickson. It is submitted that these claims are not anticipated by Erickson. In order to anticipate these claims, Erickson must show each and every

feature of these claims. Erickson does not. For example, there is no disclosure in Erickson of a nickel based superalloy which is both "pore free" and "eutectic $\gamma - \gamma'$ free". While Erickson may disclose a HIP treatment for his alloy, it is nothing like that performed by Applicants. For example, not the pressure difference between Erickson's HIP process and Applicants (1500 psi (Erickson) v. 13 - 16.5 ksi (Applicants)). There are other differences between the HIP treatment performed by Applicants and that performed by Erickson. It should be also noted that "nearly complete pore closure" is not "pore-free". Thus, there is no teaching or suggestion in Erickson of forming a "pore free" nickel superalloy. With regard to table 4 and the processing set forth therein, Erickson is trying to solution γ' to remove γ' particles for creep purposes. As can be seen from the table, occasionally Erickson accomplishes this. The only one of the alloys however which potentially obtains a 100% solutionization of the γ' and falls within the claimed compositional range is alloy 10D. The remainder of the alloys which potentially obtain 100% solutionization of the γ' contain rhenium contents in excess of 5.0 wt%. There is nothing in the patent which would indicate that this alloy after processing was "eutectic $\gamma - \gamma'$ free". For these reasons, claims 1, 4 (as amended), 6, 10 (as amended) and 24 are allowable over Erickson.

Claims 2, 3, 5, and 26 are allowable for the same reasons as claims 1 and 24 as well as on their own accord.

With respect to the rejection of claims 4, 7 - 11, and 25 on obviousness grounds over Erickson, it is submitted that the Examiner has not made out a *prima facie* case of obviousness. There is absolutely nothing in Erickson which would lead one or teach one of ordinary skill in the art to form a nickel base superalloy having the claimed composition and the claimed particle shapes and particle sizes of claim 4, the large particle sizes of claim 7, the large particle size volume of claims 8 and 9, the fine particles size of claim 10, the particle shapes of claim 11, and the claimed particle sizes of claim 25. As can be seen from the complex processing employed by Applicants, one of ordinary skill in the art having Erickson before him could not form the claimed large and fine γ' particles and distribution without an inordinate amount of experimentation because there is no guidance in Erickson of how to form such particles. There is also nothing in Erickson which would motivate one of ordinary skill in the art to form a nickel base superalloy having the features set forth in claims 4, 7 - 11, and 25.

For the foregoing reasons, claims 1 - 11 and 24 - 26 are believed to be in condition for allowance. Such allowance is respectfully solicited.

Should the Examiner believe that an additional amendment is needed to place the case in condition for allowance, he is invited to contact Applicants' attorney at the telephone number below.

The fee of \$168.00 for the extra independent claim(s) should be charged to Deposit Account No. 21-0279. If the Commissioner determines that an additional fee is due, he is hereby authorized to charge said fee to Deposit Account No. 21-0279.

Respectfully submitted,

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on December 30, 2002

Antoinette Sullo
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Signature
12-30-02
Date of Signature

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 3, 4, 10, and 11 have been amended as follows:

3. (Amended) A nickel base superalloy according to claim 2, wherein said bimodal γ' distribution includes a uniform distribution of large γ' [precipitates] particles in a continuous gamma matrix and a second and uniform distribution of fine γ' particles.

4. (Amended) A nickel base superalloy [according to claim 3, wherein] comprising 3.0 to 12 wt% chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, up to 5.0 wt% rhenium, 6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt% carbon, up to 0.02 wt% boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting of ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel, said nickel base superalloy having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free, said microstructure having a gamma prime morphology which includes a bimodal γ' distribution, said

particles in a continuous gamma matrix and a second and uniform distribution of fine γ' particles, said large γ' particles [are] being octet shaped and [have] having an average particle size in the range of 1.0 μ to 20 μ and the fine γ' particles [are] being cuboidal particles and [have] having an average particle size in the range of from 0.45 μ to 0.55 μ .

10. (Amended) A single crystal nickel base superalloy [according to claim 7, wherein] having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free and a gamma prime morphology which includes a bimodal γ' distribution having large γ' particles with a particle size in the range of from 1.0 μ to 20 μ and fine γ' particles, said fine γ' particles [have] having a particle size in the range of from 0.45 μ to 0.55 μ .

11. (Amended) A single crystal nickel base superalloy according to claim 7, wherein said large γ' particles have an octet shape and said fine γ' particles have a cuboidal shape.